


ILN ANCHOR NODES
NASA MSFC APL

The International Lunar Network (ILN) and the US Anchor Nodes mission

Update to NLSI Lunar Science Forum, 7/22/09
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The ILN and the US Anchor Nodes

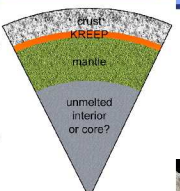
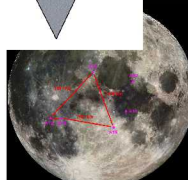
- The International Lunar Network (ILN) is a cooperative effort designed to coordinate individual lunar landers in a geophysical network on the lunar surface.
 - Each ILN station will fly a core set of instruments requiring broad geographical distribution on the Moon, plus additional passive, active, ISRU, or engineering experiments, as desired by each sponsoring space agency.
 - 24 July 2008: ILN Charter Signing Ceremony – Canada, France, Germany, India, Italy, Japan, Korea, United Kingdom
 - Ongoing: ILN Working Groups: Enabling Technologies, Landing Site, Communications, and Core Instrument Definition Working Groups.
- NASA is examining the provision of two-four ILN Anchor Nodes in the 2015-2018 timeframe.
 - Anchor Nodes Science Definition Team completed Final Report Jan 2009, available on NLSI website
 - Engineering Pre-Phase A activities

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A Lunar Geophysical Network

- The Moon is an **active, differentiated, terrestrial** body, preserving a record of early planetary evolution.
- A Lunar Geophysical Network has been recommended by the Scientific Context for the Exploration of the Moon (2007), the Tempe meeting (2007), and New Frontiers in the Solar System (2008)
- The next generation of geophysical measurements have to improve on our current knowledge
 - wider geographical placement
 - more sensitive instrumentation
 - longer baseline of observations

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Anchor Node Science Objectives & Baseline Instruments (from Science Definition Team (SDT) Jan 2009 report)

Objective	Instrument
1. Understand the current seismic state and determine the internal structure of the Moon	Three axis broadband seismometer
2. Measure heat flow to characterize the temperature structure of the lunar interior	Temperature and thermal conductivity measurements to depths > 3 m
3. Use electromagnetic sounding to measure the conductivity structure of the lunar interior	Electromagnetic Sounding Experiment
4. Determine deep lunar structure by installing next-generation laser ranging capability	Laser ranging experiment

- Seismometers must simultaneously and continuously operate for 6 years (to capture lunar tidal cycle); others may operate for less time
- 4 nodes minimum to accurately locate a shallow moonquake anywhere on the lunar surface; 2 minimum to investigate lunar core only
- Strong science desire for far-side placement to investigate global properties (heat flow in highlands and SPA terrains, crustal thickness, etc.)

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Notional Instrument Payload Used for Lander Trades

Configuration	Measurement	Instrument*	Mass (kg)	Data (Mb/day)	Power (W)	Accommodation
Floor and Baseline	Seismometry	Seismometer (ExoMars)	5	100	2.8	Good surface contact Vibration Isolation Thermal Isolation
Baseline Only	Heat Flux	HP3 mole (ExoMars)	1.5	10	5.7 pk 9 nonop	Repel/attach to 3 m Initial vertical alignment Minimize thermal variations
	EM Sounding	Electrometer, magnetometer, langmuir probe (excl booms)	2.8	25	6.1 op 2 nonop	EM cleanliness Instrument separation from spacecraft
	Laser Ranging	Retroreflector (LRO)	0.46	0	0	< 15 deg alignment to Earth

* Representative instrument concepts used to develop lander concepts. Actual instruments are expected to be competed

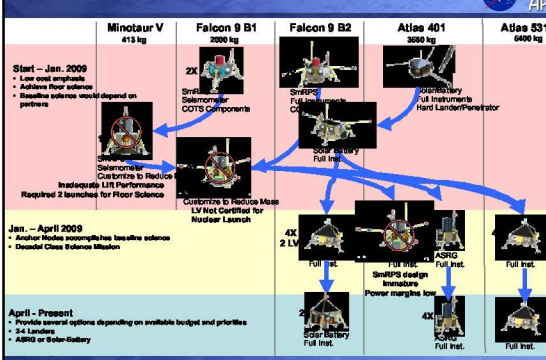
Note: Values in tables represent current best estimates and do not carry margins

Some synergy may exist among SMD, ESMD (surface plasma environment, hazard avoidance), and SOMD (comm sat, laser comm testing, etc.)

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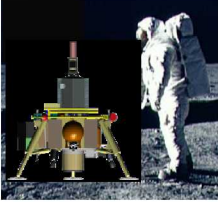
ILN Anchor Node Lander Concept Evolution



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Summary

- The International Lunar Network accomplishes high priority science by coordinating landed stations from multiple space agencies
- The Science Objectives of the network are to **understand the interior structure and composition of the moon**
- ILN Anchor Nodes are currently in development by MSFC and APL under the Lunar Quest Program
- Pre-phase A engineering assessments are complete and can achieve science requirements
- Lander design is being matured through risk reduction activities
- ILN Working Groups are ongoing and will provide guidance to mission payload and schedule



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